Submit your solutions for (up to) three of the following four exercises. If you solve all four, we will consult a random number generator to decide which three to look at and grade.

**Question 1** (10 marks)
We have seen that a simple game has a nonempty core if and only if it has at least one veto player. Our proof of the right-to-left direction of this result was constructive: by distributing the value of the grand coalition evenly amongst all veto players, we defined a specific imputation $x$ and then showed that $x$ is in the core. Building on this idea, prove the following representation theorem for the core in simple games:

*For a simple game with at least one veto player, an imputation is in the core if and only if it makes a zero payment to every player who is not a veto player.*

Finally, briefly comment on how to interpret this result. Is it a positive result?

**Question 2** (10 marks)
Recall the four axioms characterising the Shapley value for TU games. For each of them, either show that it is also satisfied by the Banzhaf value or give a counterexample.

**Question 3** (10 marks)
We have seen that for any hedonic game with a symmetric profile of additively separable preferences there exists a coalition structure that is Nash stable. Now focus on hedonic games with just two players with additively separable preferences with profiles of preferences that need not be symmetric. Does every such game have a coalition structure that satisfies the property of Nash stability? How about individual stability? How about contractual stability? Justify your answers. Then repeat the exercise for games with three players.

**Question 4** (10 marks)
Design a really good exam question for the Game Theory course.

Your question should test a student’s understanding of one or several of the concepts introduced in the course. It should go clearly beyond the mere recalling of definitions, but at the same time it should not require a significant amount of mathematical ingenuity. It should be possible to answer your question in around 10 minutes. Finally, your question should lend itself to being graded in an efficient manner. Include a sketch of the kind of answer you would want to see for your question.

We are going to grade this exercise as follows: 10 marks for a great question we could use in an exam in its present form. 8 marks for a very good question that nevertheless may require some tweaking before it could be used. 6 marks for a fair attempt. No marks for...
anything else. We are not going to assess the correctness of your suggested answer (we only ask for this because it is good practice to think about the answers you expect to see when designing an exam question—and also because it might help us to better understand what you had in mind with your question).